

A new species of *Bathymacraea* (Gastropoda: Pectinodontidae) from a methane seep area in the South China Sea

Shuqian Zhang
Junlong Zhang
Suping Zhang¹

Institute of Oceanology,
Chinese Academy of Sciences
Qingdao 266071, CHINA

¹museum@qdio.ac.cn

ABSTRACT

Bathymacraea lactea new species, collected from a methane seep area in the South China Sea, is described and illustrated, as the sixth species of the genus *Bathymacraea* Okutani, Tsuchida and Fujikura, 1992. The generic assignment is primarily based on radula morphology, which has a formula of 0-1-0-1-0 and each lateral teeth consists of three cusps. The new species resembles *Bathymacraea jonassoni* Beck, 1996, *Bathymacraea tertia* Sasaki, Okutani, and Fujikura, 2003, and *Bathymacraea secunda* Okutani, Fujikura and Sasaki, 1993 in having relatively smooth shell sculpture, but differs from those species by its much thicker shell, strongly chipped aperture margin forming denticle-like structures, and radular morphology.

Additional keywords: Patellogastropoda, Lottioidea, cold seep, radula

INTRODUCTION

The genus *Bathymacraea* was established by Okutani, Tsuchida, and Fujikura (1992: 140) on the basis of single species, *Bathymacraea nipponica*, off Hatsushima Islet, Japan. Since then, four species have been described by subsequent authors, *Bathymacraea secunda* Okutani, Fujikura, and Sasaki (1993: 130, figs 13–19) from Minami Ensei Knoll and Iheya Ridge, Japan, *Bathymacraea jonassoni* Beck (1996: 90, text-fig. 3, plate 2) from Edison Seamount, off Lihir Island, *Bathymacraea subnipponica* Sasaki, Okutani, and Fujikura (2003: 193, fig. 6) from Ryuyo Canyon, Japan and *Bathymacraea tertia* Sasaki, Okutani, and Fujikura (2003: 190, figs 3B, 4, 5) from North Knoll of Iheya Ridge, Japan. In addition, an unnamed species, *Bathymacraea* sp., was also reported by Sasaki, Okutani, and Fujikura (2003: 195, fig. 7) from the Sumisu Caldera, Japan. Up to now, all known members

of this genus are restricted to deep sea areas in the western Pacific.

Since the beginning of exploration of the benthic communities associated with hydrothermal vents, seeps, and seamounts carried out in the western Pacific, many interesting and new species of mollusks have been reported (Beck, 1992; Hasegawa, 1997; Hasegawa et al., 1997; Waren and Bouchet, 2001; Hasegawa, 2005; Sasaki et al., 2005, 2008). The investigations of hydrothermal vents and seeps by the Institute of Oceanology, Chinese Academy of Sciences (IOCAS) started in 2014, and during research dives by the submersible ROV FAXIAN in April of that year, five specimens of patelliform gastropod were collected from cold seep areas in the South China Sea. Observations of the shell and radular morphology reveal that they represent an undescribed species belonging to *Bathymacraea*. In this paper, we describe and illustrate this species as new to science, and compare it with other congeners.

MATERIALS AND METHODS

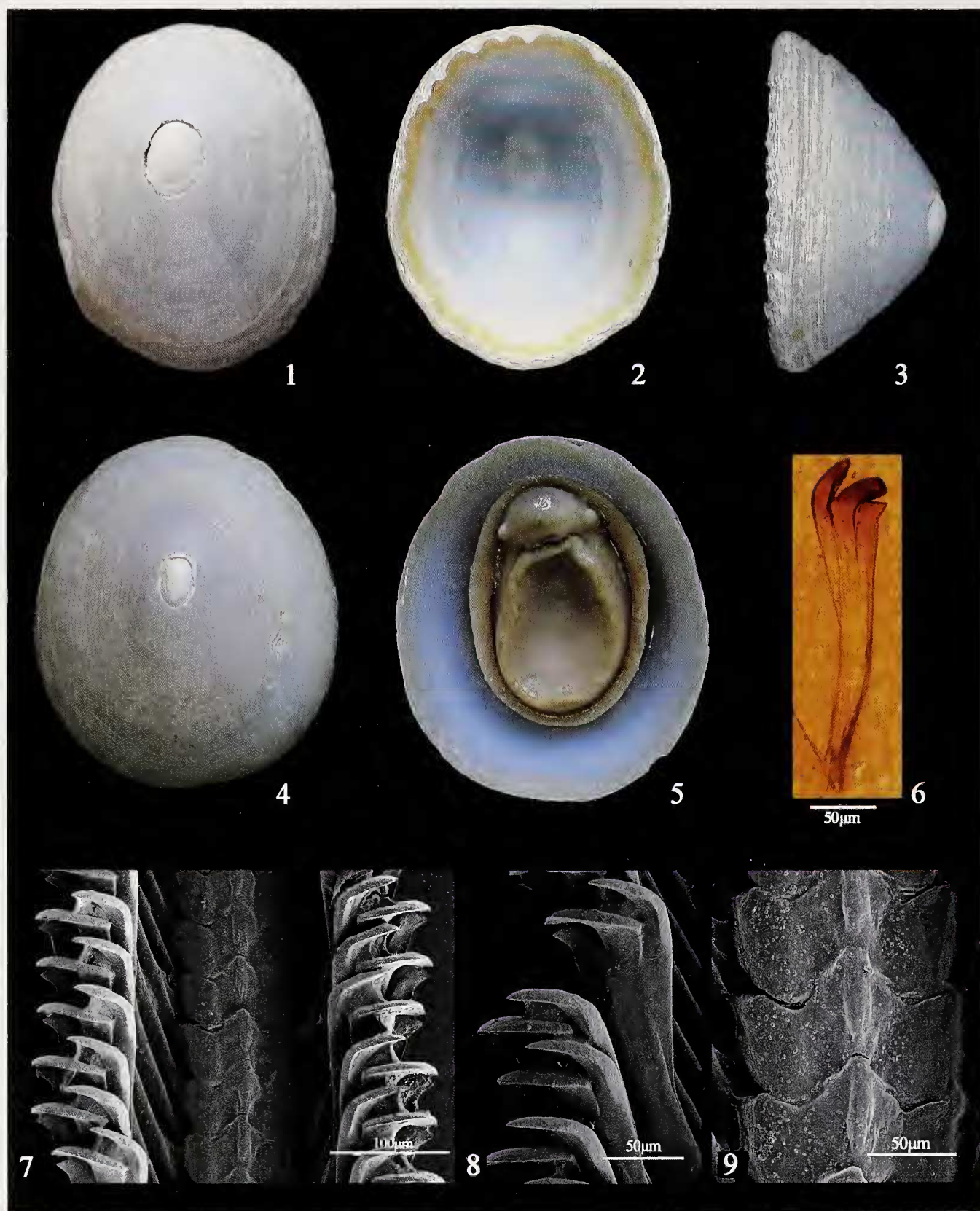
A total of five specimens were collected during two dives of the ROV FAXIAN (IOCAS) in April, 2014 at a methane seep area in the South China Sea. The materials were fixed in 99.5% ethanol directly after collection. The shell and soft part were observed under light microscopy, and the radular structure under a scanning electron microscope (SEM).

For SEM studies, radular sacs were removed and placed in 10% NaOH solution for 4–5 hours. The radula was then dehydrated through an ethanol series and laid on a cover slip to air-dry. The samples were then coated with gold and examined under a Hitachi S-3400N scanning electron microscope. Type material is deposited in the Marine Biological Museum, Chinese Academy of Sciences (MBMCAS), Qingdao, China.

SYSTEMATICS

Family Pectinodontidae Pilsbry, 1891

¹ Author for correspondence



Figures 1–9. *Bathyacmaea lactea* new species. 1–3. Dorsal, ventral, and lateral view of holotype. 4–5. Dorsal and ventral view of paratype. 6–9. Radula. 6. Single lateral tooth under light microscopy. 7. Dorsal view of intact radular segment. 8. Enlargement of right lateral teeth. 9. Basal plates representing rachidian teeth.

Genus *Bathyacmaea* Okutani, Tsuchida, and Fujikura, 1992

Type Species: *Bathyacmaea nipponica* Okutani, Tsuchida and Fujikura, 1992 (Hatsushima Islet, Japan).

***Bathyacmaea lactea* new species**

(Figures 1–9)

Diagnosis: Shell whitish, longitudinally elongated. Shell surface with relatively smooth sculpture consisting of dense growth lines and microscopic radial threads. Apertural margin strongly chipped, forming denticle-like structure. Radular formula 0-1-0-1-0. Lateral teeth trifurcated, with straight, stout shaft. All three cusps outwardly bent; innermost and middle cups sickle-shaped and subequal in size, outermost one smallest, with acute tip.

Description: Shell (Figures 1–5) patelliform, very thick (ca. 1.5 mm and ca. 1.2 mm above aperture margin in holotype and paratype, respectively), and solid, with oval outline, longer than wide, width about 82–87% of length, anterior end slightly narrower than posterior end. Profile high for genus, height about 43–49% of shell length. Apex situated at anterior 2/5 of shell length. Protoconch rounded and smooth. Anterior slope more or less straight and posterior slope slightly convex. External surface opaque white, sculptured with dense irregular growth lines and microscopic radial threads, the growth lines relatively thin near the apex but gradually stronger toward the apertural margin. Apertural margin strongly chipped, forming denticle-like structure in holotype but less prominent in paratype. Internal surface opaque whitish with exception of yellowish near apertural margin in holotype.

Animal (Figures 5, 10) with very short tentacles, eyes lacking. Head stout and rounded, without oral lappets. Ctenidium bipectinate and large. Intestine blackish due to dark-grey contents, stomach very large, C-shaped, situated in central position and partly covered by digestive gland. Intestine and stomach containing lumpish and spongy material. Gonad situated at posterior end of visceral mass. Urogenital papilla digitiform in shape, situated on right rear corner of ctenidium.

Radula (Figures 6–9) docoglossate with formula 0-1-0-1-0. Rachidian tooth represented by longitudinal, ridge-like structure. Rachidian basal plate wider than long, mid-anterior edge and anterior outer corners markedly protruded. Lateral tooth trifurcated, and with straight, stout shaft. All three cusps outwardly bent, innermost and middle cusps sickle-shaped and subequal in size, outermost one smallest with an acute tip.

Type Locality: A methane seep area at 22°07' N, 119°18' E, in 1132.5 m depth, South China Sea.

Type Material: Holotype MBM283045 (length 18.5 mm, width 15.2 mm, height 9.1 mm), from type locality; Paratype MBM283046 (length 19.6 mm, width 17.0 mm, height 8.5 mm), 22°06' N, 119°17' E, in 1,132 m, methane seep area, South China Sea. Three additional immature specimens, one collected with holotype (type locality)

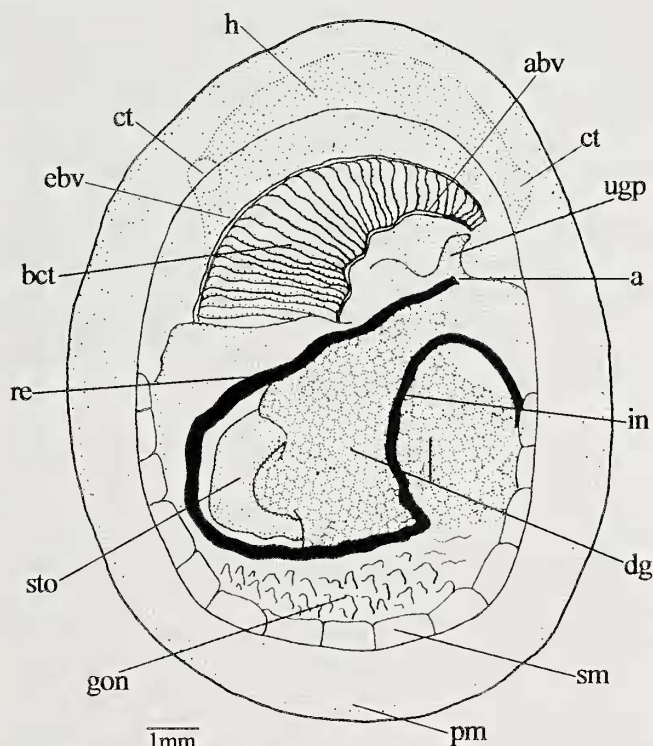


Figure 10. Paratype of *Bathyacmaea lactea* new species. Dorsal view, shell removed, head and cephalic tentacles shown by transparency. Abbreviations: a, anus; abv, afferent branchial vein; bct, bipectinate ctenidium; ct, cephalic tentacle; dg, digest gland; ebv, efferent branchial vein; gon, gonad; h, head; in, intestine; pm, pallial margin; re, rectum; sm, shell muscle; sto, stomach; ugp, urogenital papilla.

and the other two with the paratype, were also observed. All collected by ROV FAXIAN (Mother-ship RV KEXUE, IOCAS), April, 2014.

Etymology: Latin *lactea*, meaning milky white, a reference to the shell color of the new species.

Comparative Remarks: Members of *Bathyacmaea* are restricted to the western Pacific. Until now, five species have been reported. With exception of *Bathyacmaea jonassoni* Beck, 1996, found on a seamount, all other species were discovered within or near the chemoautosynthesis-based communities: *Bathyacmaea nipponica* and *Bathyacmaea subnipponica* from cold seeps, and *Bathyacmaea tertia* and *Bathyacmaea secunda* from hydrothermal vents.

Observations on shell and radula confirm that the new species belongs to the genus *Bathyacmaea*. Therefore, *Bathyacmaea lactea* new species represents the sixth recognized species of the genus. In shell characters, the new species differs from all congeners by its much thicker shell. *Bathyacmaea lactea* new species can be readily distinguished from *Bathyacmaea nipponica* and *Bathyacmaea subnipponica* in having relatively smooth rather than granulated or nodular shell sculpture. The new species resembles *Bathyacmaea jonassoni*,

Bathyacmaea tertia, and *Bathyacmaea secunda* in having relatively smooth shell sculpture. However, in *Bathyacmaea lactea*, the outermost cusp of lateral tooth is outward-bent, with pointed tip, whereas in *Bathyacmaea tertia* the outermost cusps of the lateral tooth are straight with a gently arched outer edge. *Bathyacmaea lactea* is different from *Bathyacmaea secunda* in having elongated rather than nearly circular shell, moderately high instead of low shell, much wider innermost cusp and much more slender outermost cusp of lateral teeth. *Bathyacmaea jonassoni* can be separated from the new species in having much more elongated and slender shafts of lateral teeth.

ACKNOWLEDGMENTS

This research was supported by the Strategic Priority Research Program of the Chinese Academy of Sciences (XDA11030201). We would like to express our sincere thanks to the crews of R/V KEXUE for their cooperation during the survey. Thanks also to Dr. Lothar A. Beck for providing us important references.

LITERATURE CITED

- Beck, L.A. 1992. Two new neritacean limpets (Gastropoda: Prosobranchia: Neritacea: Phenacolepadidae) from active hydrothermal vents at Hydrothermal Field 1 "Wienerwald" in the Manus Back-Arc Basin (Bismarck Sea, Papua-New Guinea). *Annalen des Naturhistorischen Museums in Wien* 93(B): 259–275.
- Beck, L.A. 1996. Morphology and anatomy of new species of neolepetopsid, aemaeid, fissurellid and pyropeltid limpets from Edison Seamount off Lihir Islands (West Pacific). *Archiv für Molluskenkunde* 125: 87–103.
- Hasegawa, H. 2005. A preliminary list of deep sea gastropods from Nansei Islands, Southwestern Japan. *National Science Museum Monographs* 29: 137–190.
- Hasegawa, K. 1997. Sunken wood-associated gastropods collected from Suruga Bay, pacific side of the Central Honshu, Japan, with descriptions of 12 new species. *National Science Museum Monographs* 12: 59–123.
- Hasegawa, K., K. Fujikura, and T. Okutani. 1997. Gastropod fauna associated with hydrothermal vents in the Mariana Back-Arc Basin: Summary of the results of 1996 "Shinkai 6500" dives. *JAMSTEC Journal of Deep-Sea Research* 13: 69–83.
- Okutani, T., K. Fujikura, and T. Sasaki. 1993. New taxa and new distribution records of deep sea gastropods collected from or near the chemosynthetic communities in the Japanese waters. *Bulletin of National Science Museum series A*: 123–143.
- Okutani, T., E. Tsuchida, and K. Fujikura. 1992. Five bathyal gastropods living within or near the *Calymene*-community of the Hatsushima Islet, Sagami Bay. *Venus* 51: 137–148.
- Sasaki, T., T. Okutani, and K. Fujikura. 2003. New taxa and new records of patelliform gastropods associated with chemoautotrophic-based communities in Japanese waters. *The Veliger* 46: 189–210.
- Sasaki, T., T. Okutani, and K. Fujikura. 2005. Molluscs from hydrothermal vents and cold seeps in Japan: A review of taxa recorded in twenty recent years (1984–2004). *Venus* 64: 87–133.
- Sasaki, T., T. Okutani, and K. Fujikura. 2008. A new species of *Pyropelta* (Gastropoda: Pyropeltidae) from hydrothermal vents in the Okinawa Trough, southwestern Japan. *Journal of Molluscan Studies* 74: 309–316.
- Warren, A. and P. Bouchet. 2001. Gastropoda and Monoplacophora from hydrothermal vents and seeps; new taxa and records. *The Veliger* 44: 116–231.